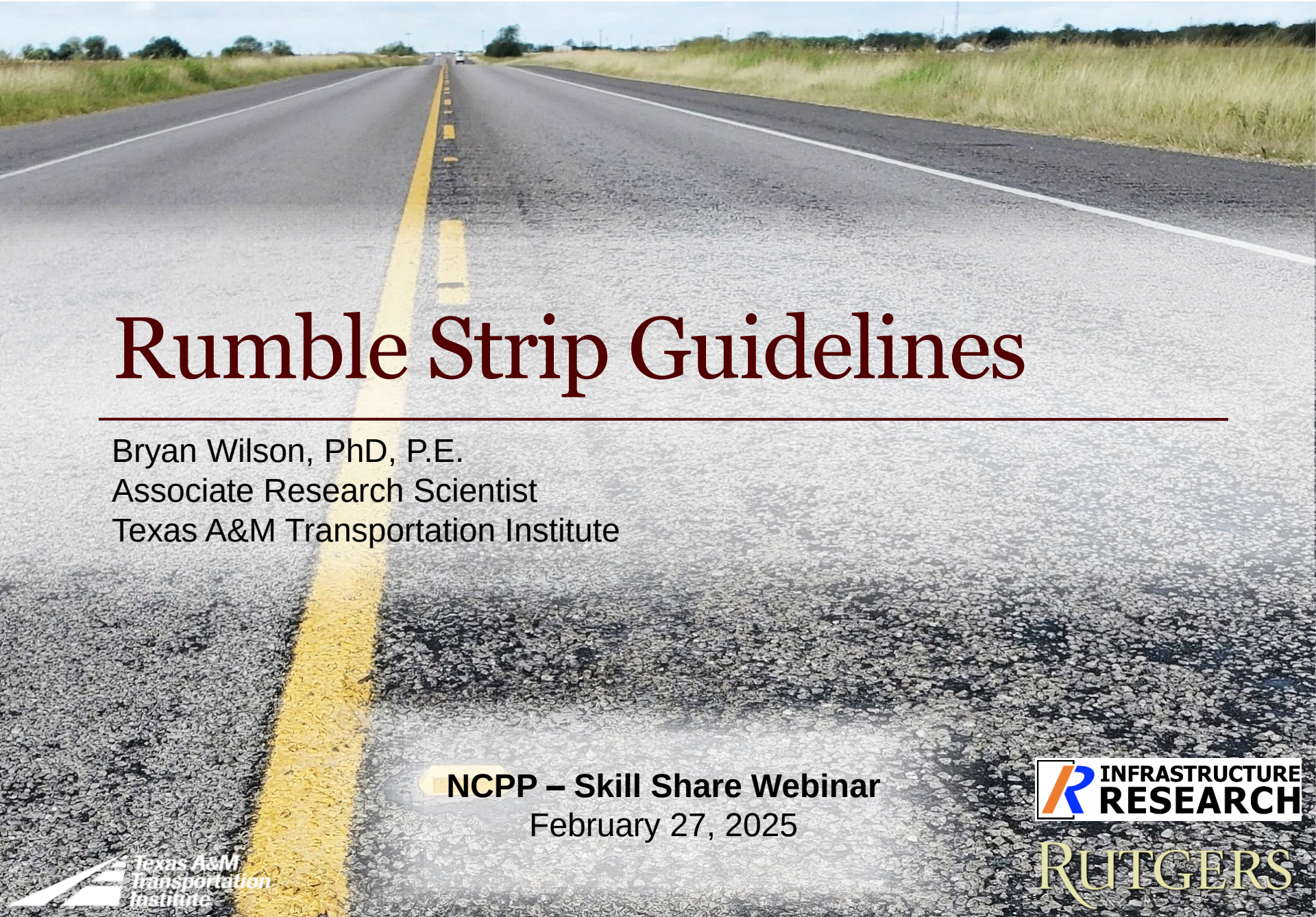

Rumble Strip Guidelines

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Texas A&M Transportation Institute

NCPP – Skill Share Webinar
February 27, 2025

Texas A&M Transportation Institute

INFRASTRUCTURE RESEARCH

RUTGERS

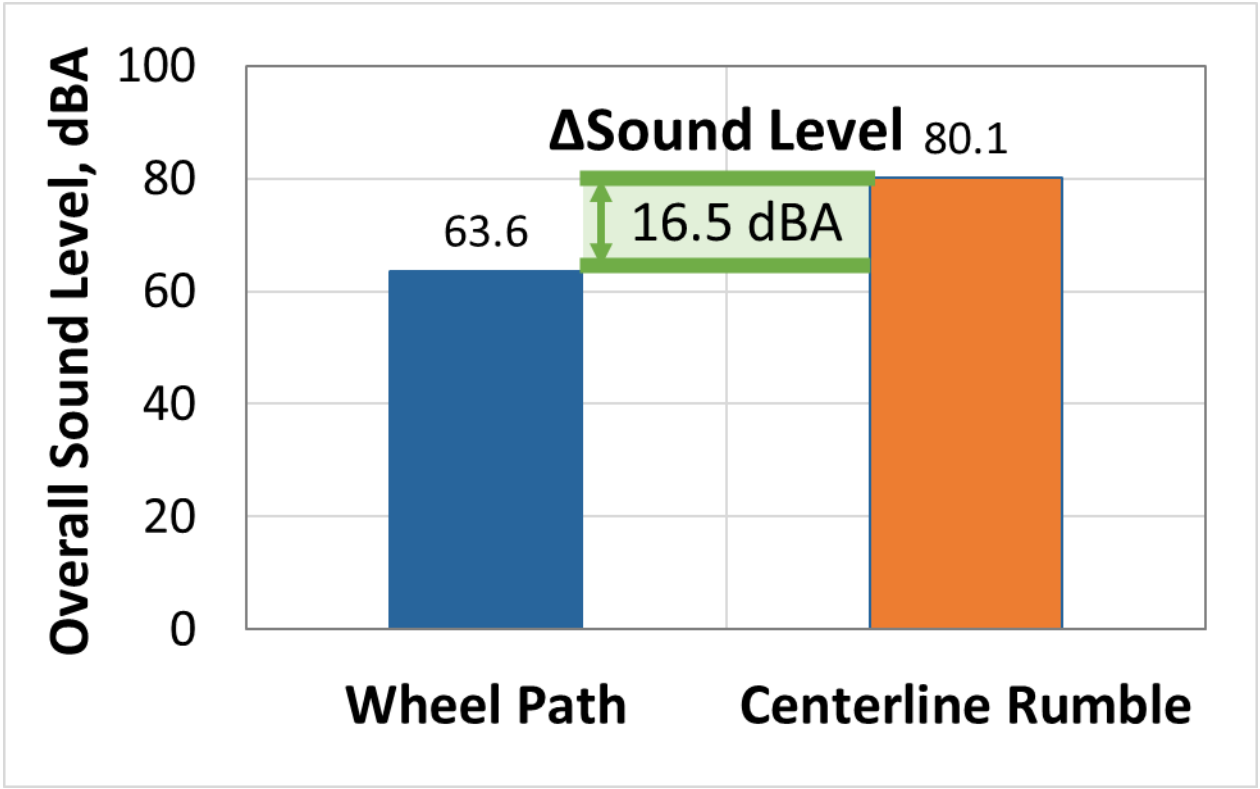
Projects and Topics

- TxDOT Project 0-7029: *Evaluation of the Performance of Rumble Strips on Pavements Where Seal Coats Have Been Applied*
  - Sound performance when covered with chip seal.

- NCHRP Project 14-46: *Guidelines for the Maintenance and Construction of Rumble Strips*
  - Factors for long-lasting rumble strips,
  - Pavement and maintenance perspective.

Sound Performance

- Change in sound from wheel path to rumble strip.

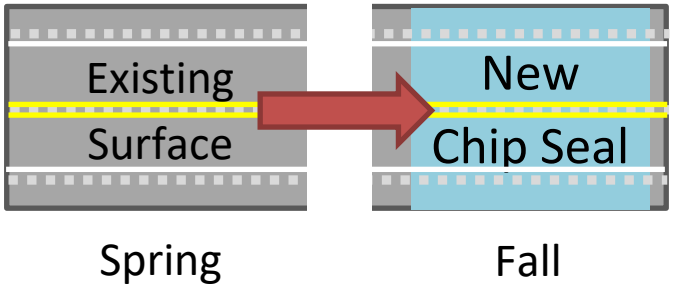


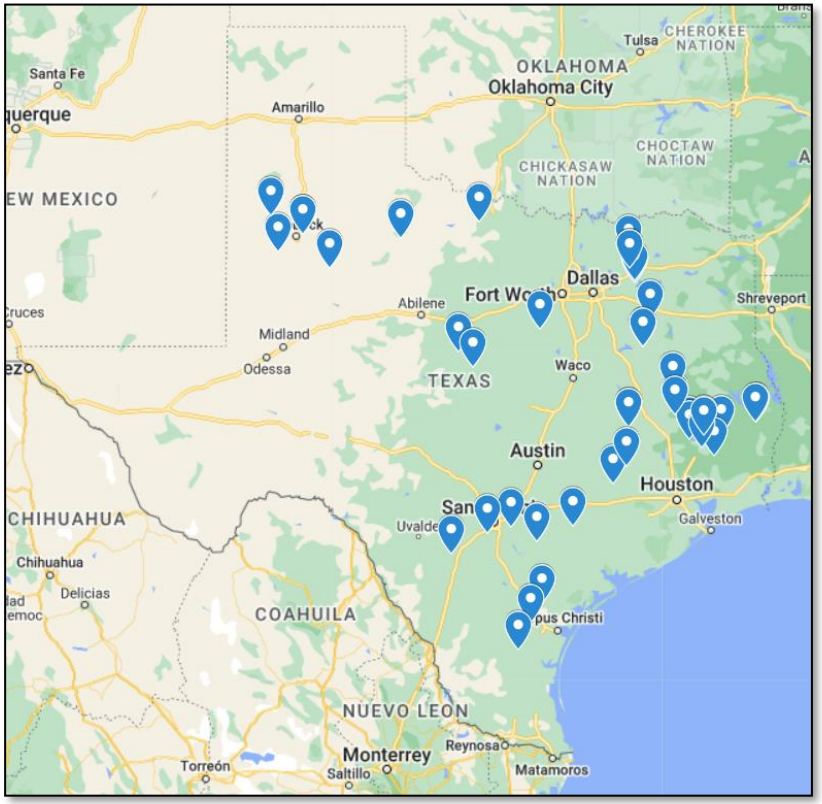
Rating	ΔSound Level (dB)
Low	<Δ6
Moderate	Δ6 to Δ10
High	>Δ10

TTI Study Summary

GOAL	Determine how many layers of seal coat can be applied before the rumble strip is compromised.

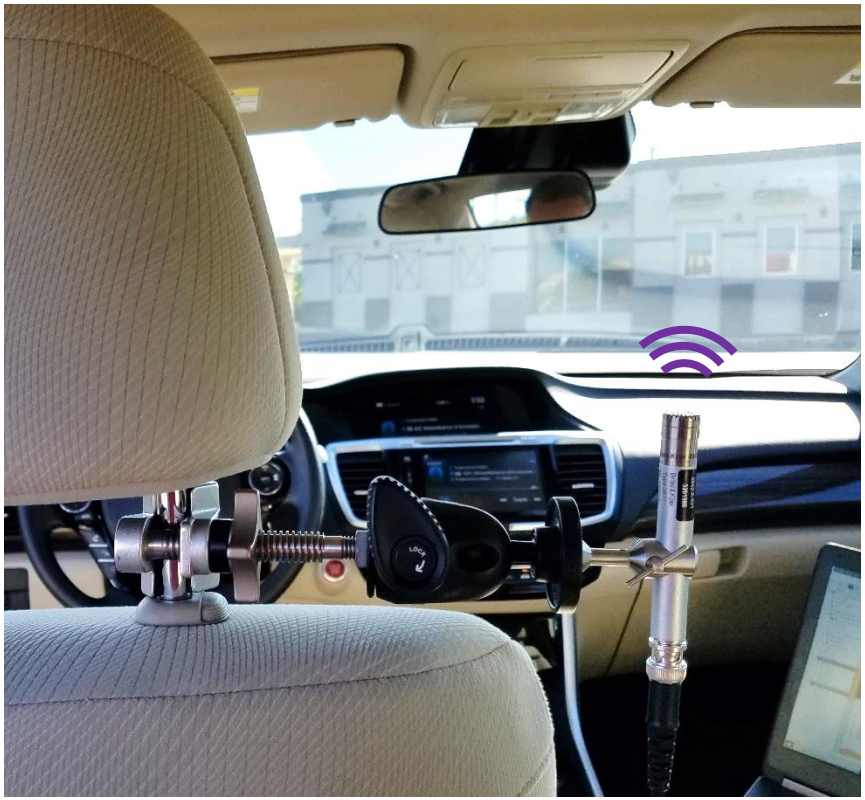
- 34 chip seal projects.
- 54 rumble strip sites.
- Before/After testing.





Measurements

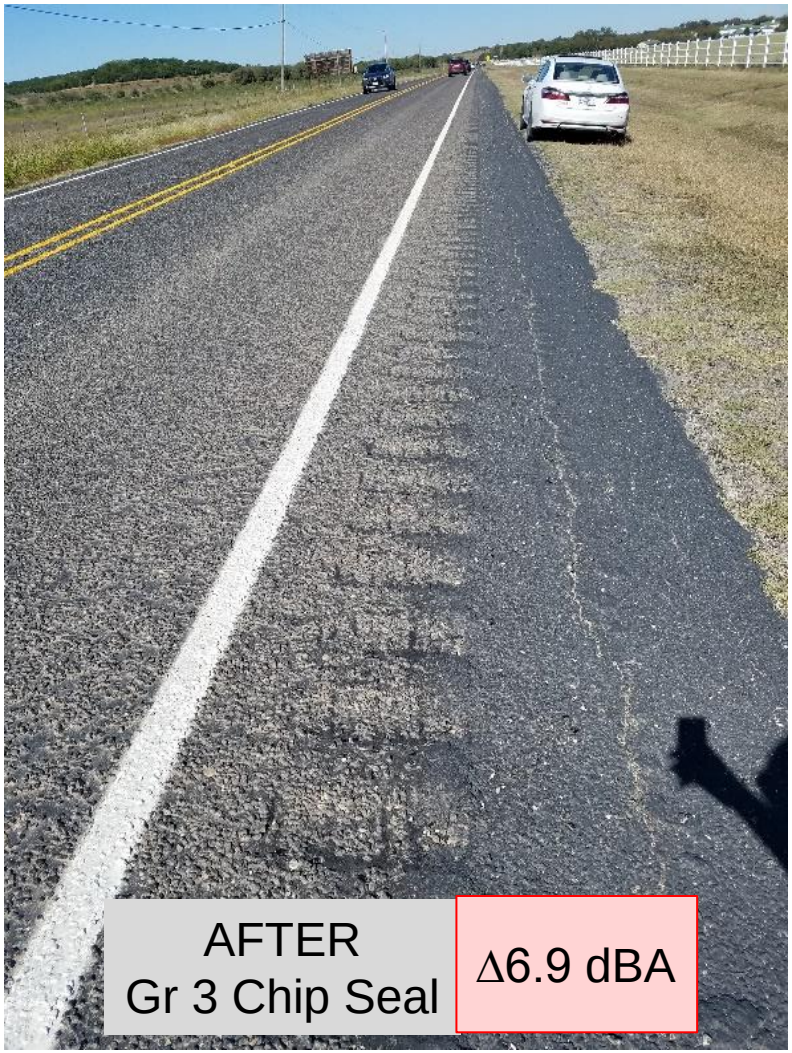
Sound



Acceleration

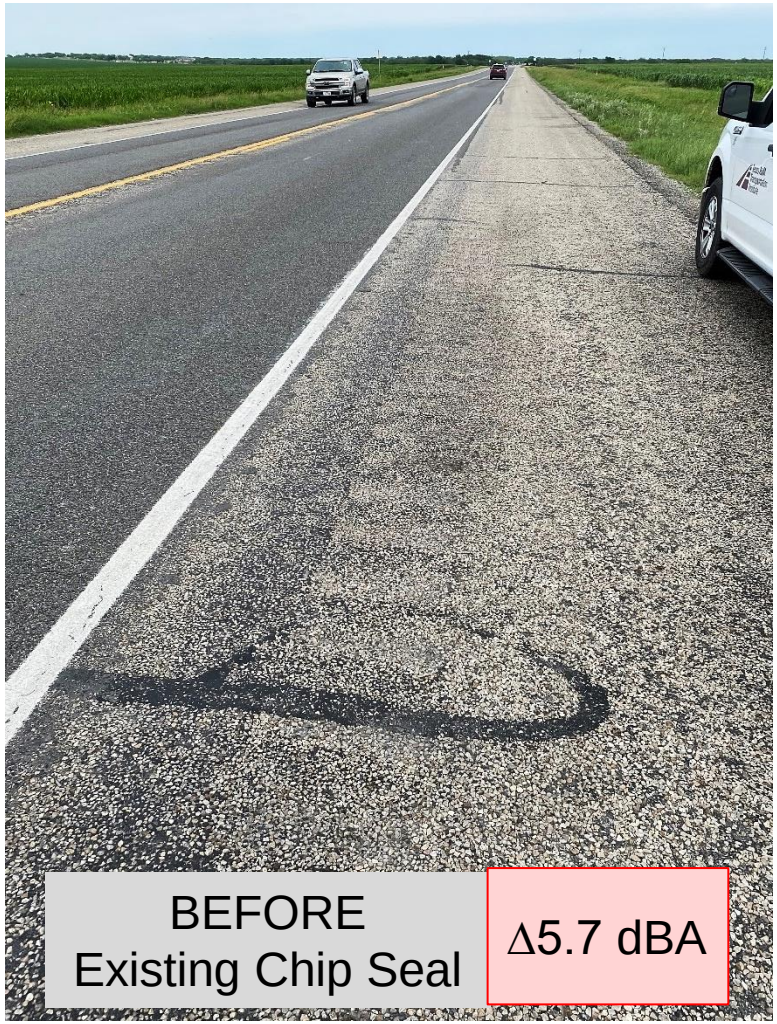
Vehicle: Passenger car, Pick-up Truck
Speed: 55 mph, 70 mph

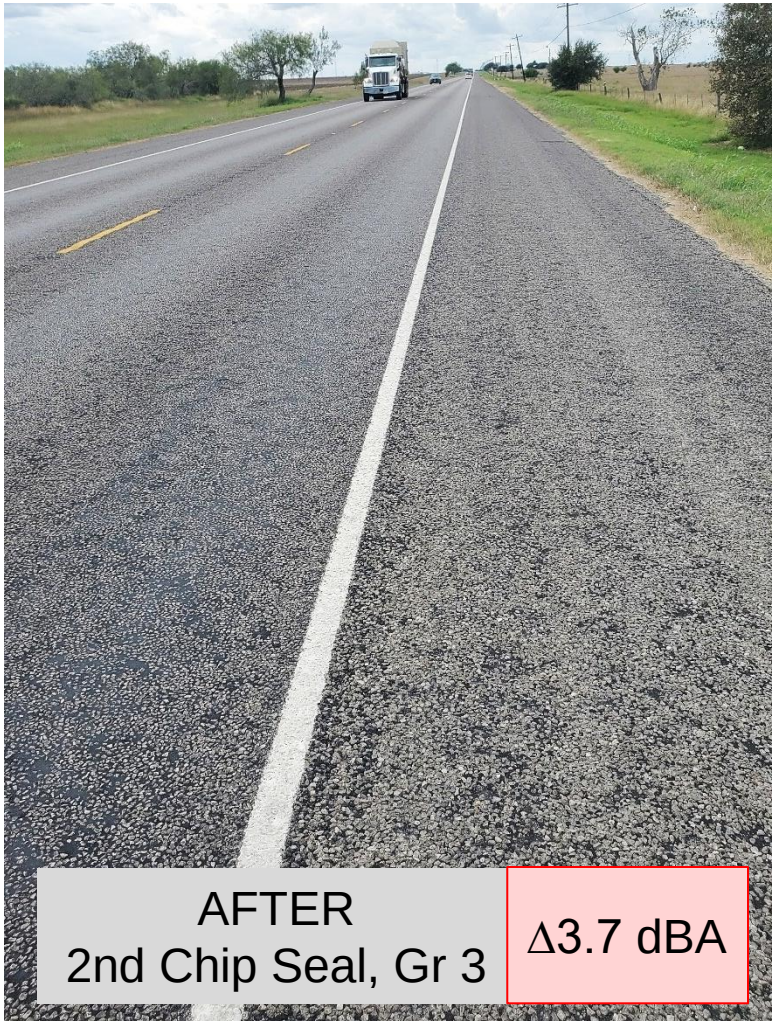
Example (FTW-SH144)



Truck_70mph and Car_55mph

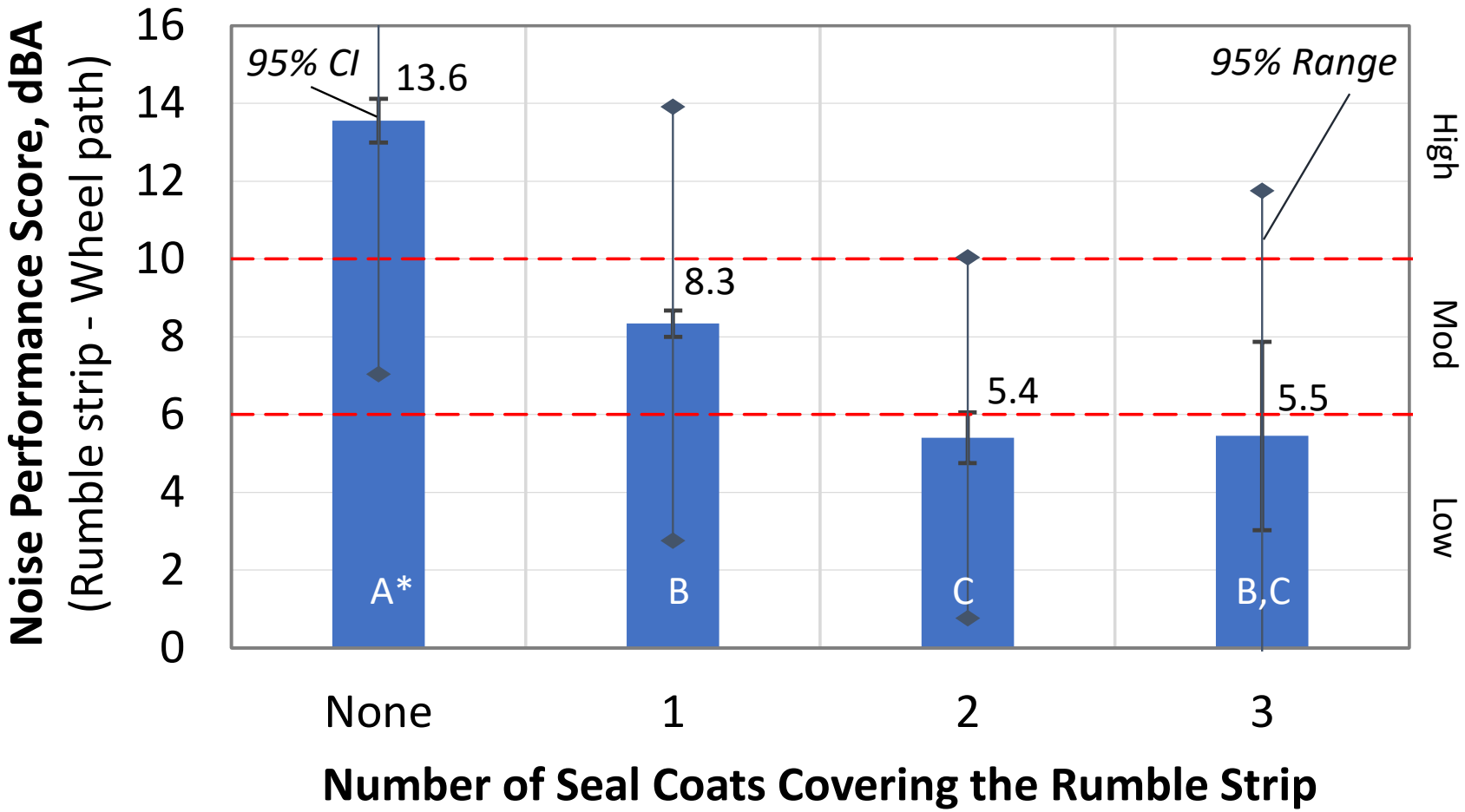
Example (CRP-SH359)





Truck_55mph and Car_70mph

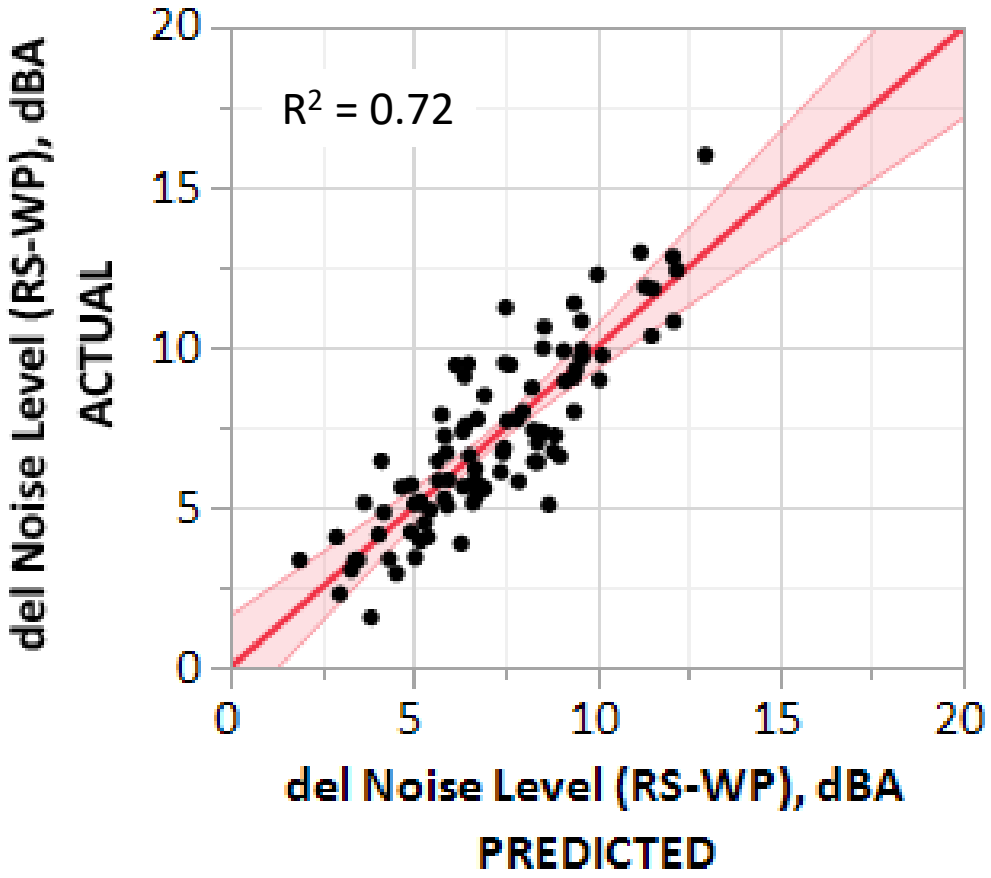
Effect of Number of Chip Seal



** Statistical grouping*

Most Significant Factor?

Model for PREDICTING Sound Performance



w/ several input factors, including… ΔSound Level **Before** Chip Seal

Performance Prediction Design Models

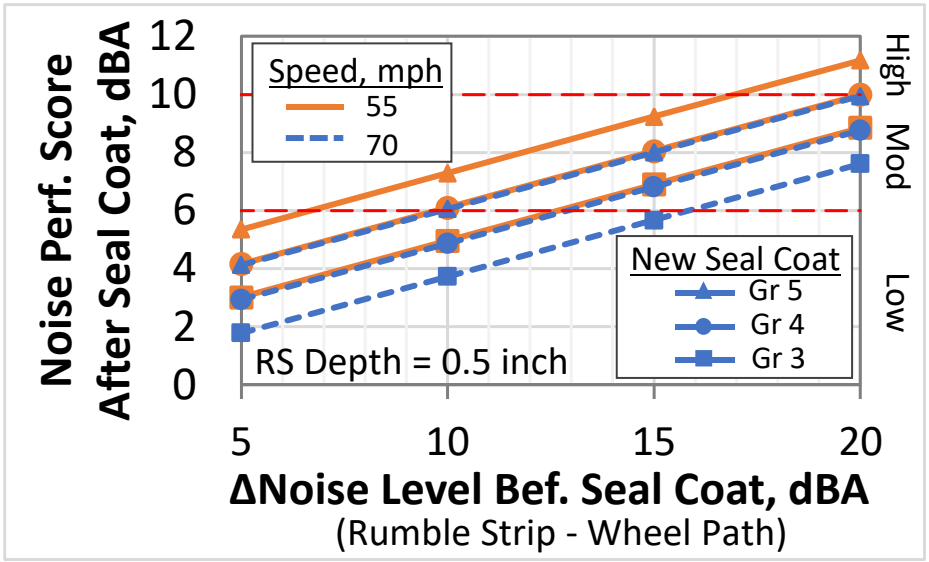
- **Level I** (Highest accuracy, $R^2 = 0.72$)
  - Two field measurements: Sound performance *before* the seal coat and Rumble strip depth.
- **Level II** (Moderate accuracy, $R^2 = 0.53$)
  - One field measurement: Rumble strip depth.
- **Level II** (Low accuracy, $R^2 = 0.32$)
  - No field data.

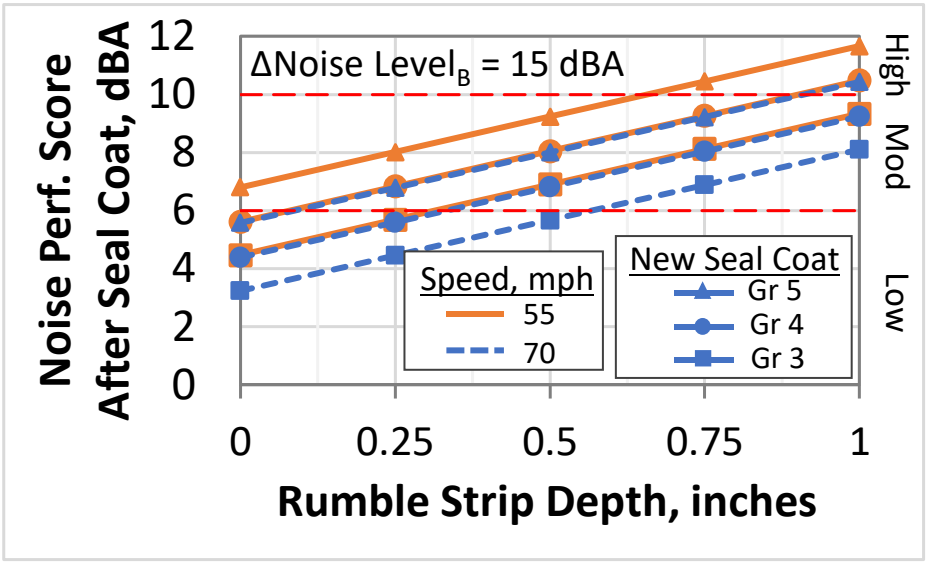
- All models include *seal coat grade type* and *speed limit*.

Level I Prediction Design Model

Percent Confidence

$$5.56 + 0.39 \times \Delta Sound_{BeforeSC} + 4.86 \times Depth_{RS} + \begin{cases} -1.16 & if\ Grade\ 3 \\ -0.01 & if\ Grade\ 4 \\ 1.17 & if\ Grade\ 5 \end{cases} - 0.082 \times SpeedLimit - \begin{cases} 0 & if\ 50\%\ (Average) \\ \mathbf{1.25} & \boldsymbol{if\ 75\%\ (Recommended)} \end{cases}$$





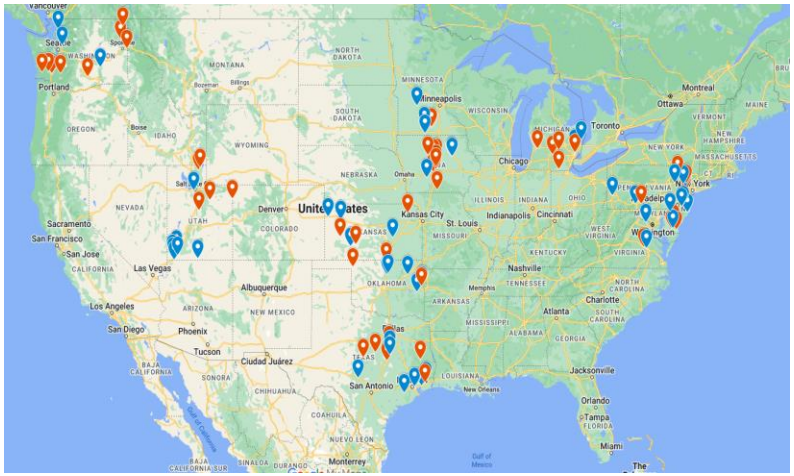
(Highest Accuracy, $R^2 = 0.72$)

Quick Rules of Thumb

1. It is OK to seal coat over an uncovered rumble strip if using Grade 4 or Grade 5. Using a Grade 3 seal requires more information.
2. If the existing sound performance is Δ15 dBA and the depth is 0.5 inches or greater, it is OK to seal over the rumble strip.
3. Do not apply seal coat over an already covered rumble strip without first checking the performance using the Level I or II models.
4. Districts that typically use Grade 3 seal coats could consider installing new rumble strips deeper (i.e., 5/8 inch) to avoid needing to reinstall rumble strips as often or apply Grade 4 seal coat on the shoulders and/or lanes instead.

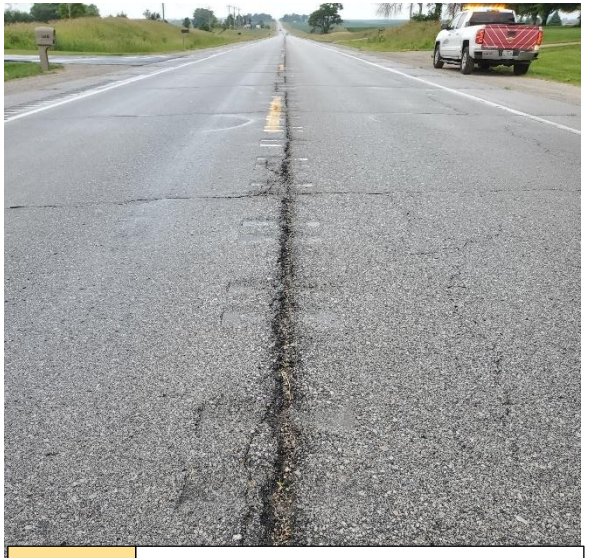
NCHRP 14-46 Summary

- State Surveys
  - 30 responding states
  - Interviews
- Field Studies
  - Rumble Strip Distress
    - 110+ rumble strips, 11 states
    - Factors: Pavement type, Rumble type, CL/EL, On/off joint, Maintenance, Install. equipment.
  - Sound After Chip Seal
    - Rectangular and sinusoidal
- Guidelines Document



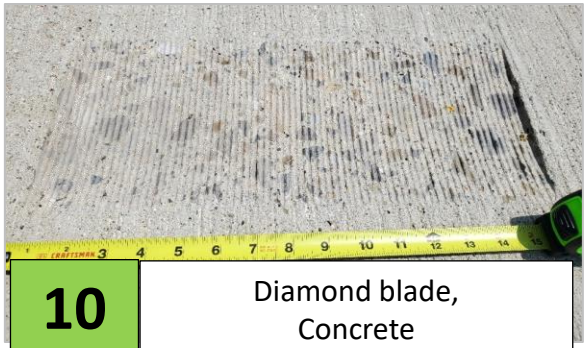
PASER Condition Survey

9.0	Rectangular RS, Shoulder, Concrete

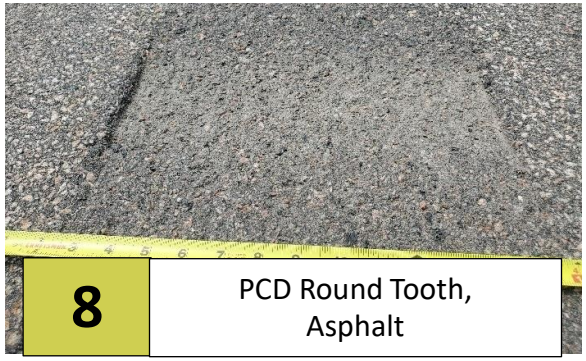


5.6	Rect. RS, Centerline, AC Overlay on Conc.

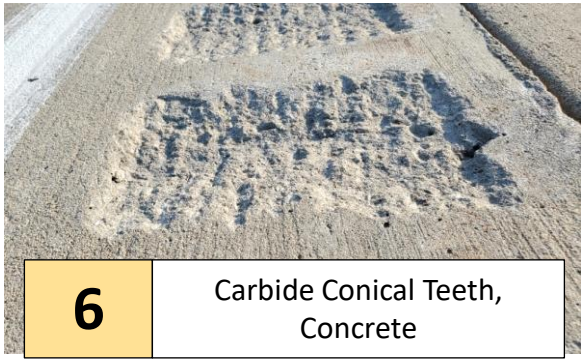
1.6	Rect. RS, Shoulder, Chip seal surface.



10	Diamond blade, Concrete



8	PCD Round Tooth, Asphalt



6	Carbide Conical Teeth, Concrete

NCHRP 14-6 Final Results

- Coming soon.

Thank you

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